

Trajectory Dispersed Vehicle Process for Space Launch System

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The Space Launch System (SLS) vehicle is part of NASA's deep space exploration plans that includes manned missions to Mars. Manufacturing uncertainties in design parameters are key considerations throughout SLS development as they have significant effects on focus parameters such as lift-off-thrust-to-weight, vehicle payload, maximum dynamic pressure, and compression loads. This presentation discusses how the SLS program captures these uncertainties by utilizing a 3 degree of freedom (DOF) process called Trajectory Dispersed (TD) analysis. This analysis biases nominal trajectories to identify extremes in the design parameters for various potential SLS configurations and missions. This process utilizes a Design of Experiments (DOE) and response surface methodologies (RSM) to statistically sample uncertainties, and develop resulting vehicles using a Maximum Likelihood Estimate (MLE) process for targeting uncertainties bias. These vehicles represent various missions and configurations which are used as key inputs into a variety of analyses in the SLS design process, including 6 DOF dispersions, separation clearances, and engine out failure studies.